KU LEUVEN

Agricultural Research Organization (ARO) Israel

Effect of cow traffic on an implemented automatic 3D vision monitor for dairy cow locomotion

Tom Van Hertem, S. Viazzi, M. Steensels, C. Bahr, C.E.B. Romanini, C. Lokhorst, A. Schlageter Tello, E. Maltz, I. Halachmi and D. Berckmans

EAAP Copenhagen - August 2014

Outline

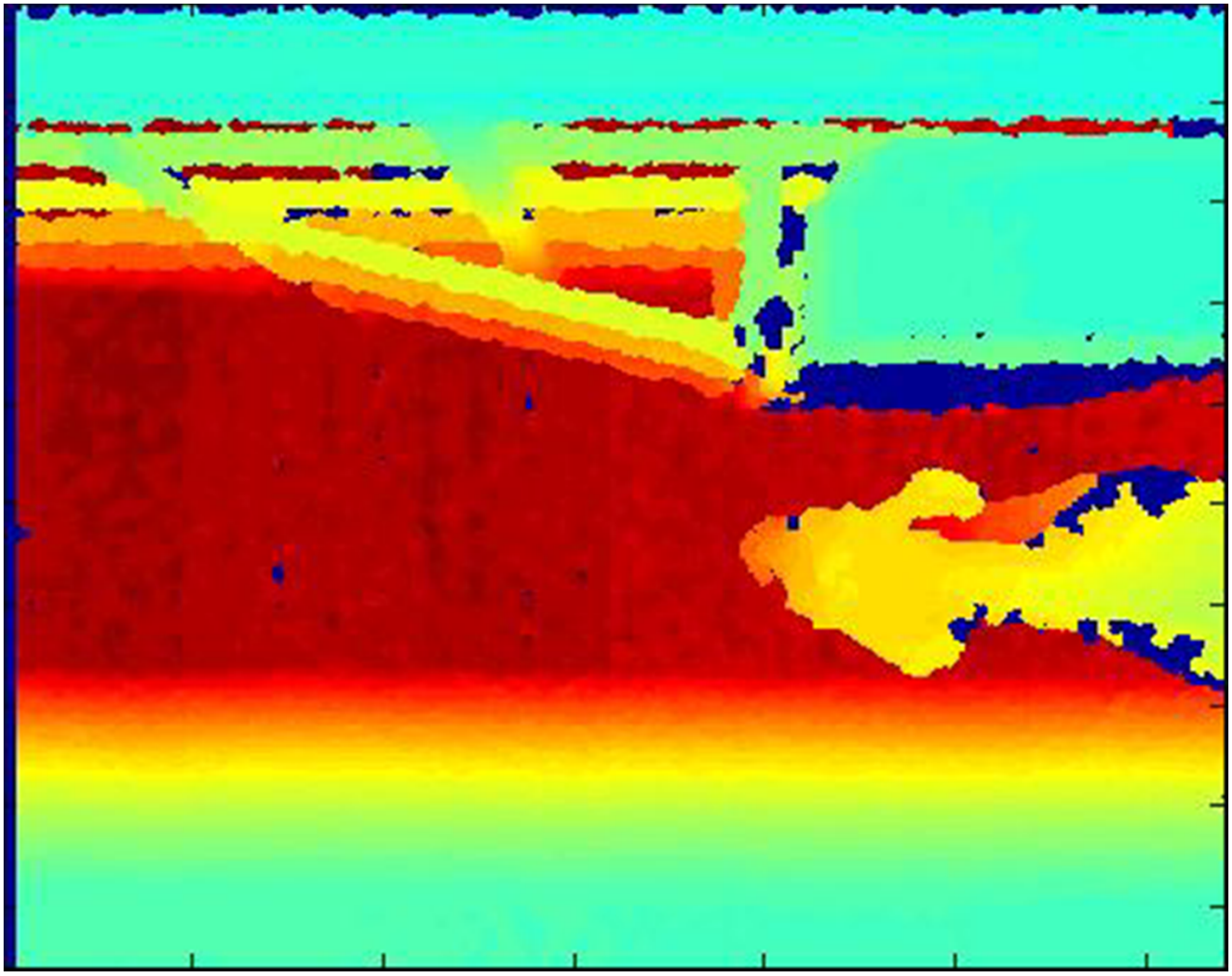
- Why 3D vision?
- Aim
- Material & Methods
- Results
- Discussion
- Conclusion

KU LEUVEN

Why 3D-vision?

- Non-invasive
- Cheap
- 1 sensor for entire herd
- New information: depth

Aim of research



3D Video

Cow segmentation

Back detection

Back spine extraction

Curvature parameters extraction

Classification

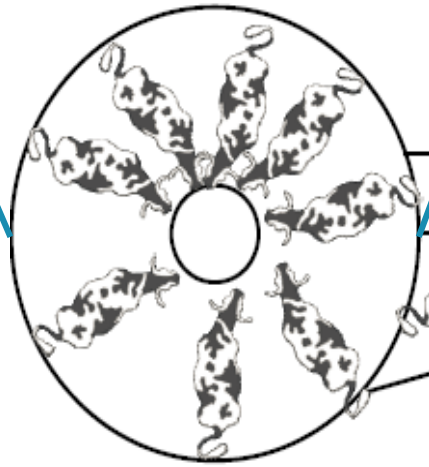
KU LEUVEN

Aim of study

- AIM
  - Evaluate the performance of a fully automatic 3D vision monitor for dairy cow locomotion in a commercial farm

- Value creation
  - Research → practice

Commercial farm layout



Waiting area

Alley

Pen Group 1

Pen Group 2

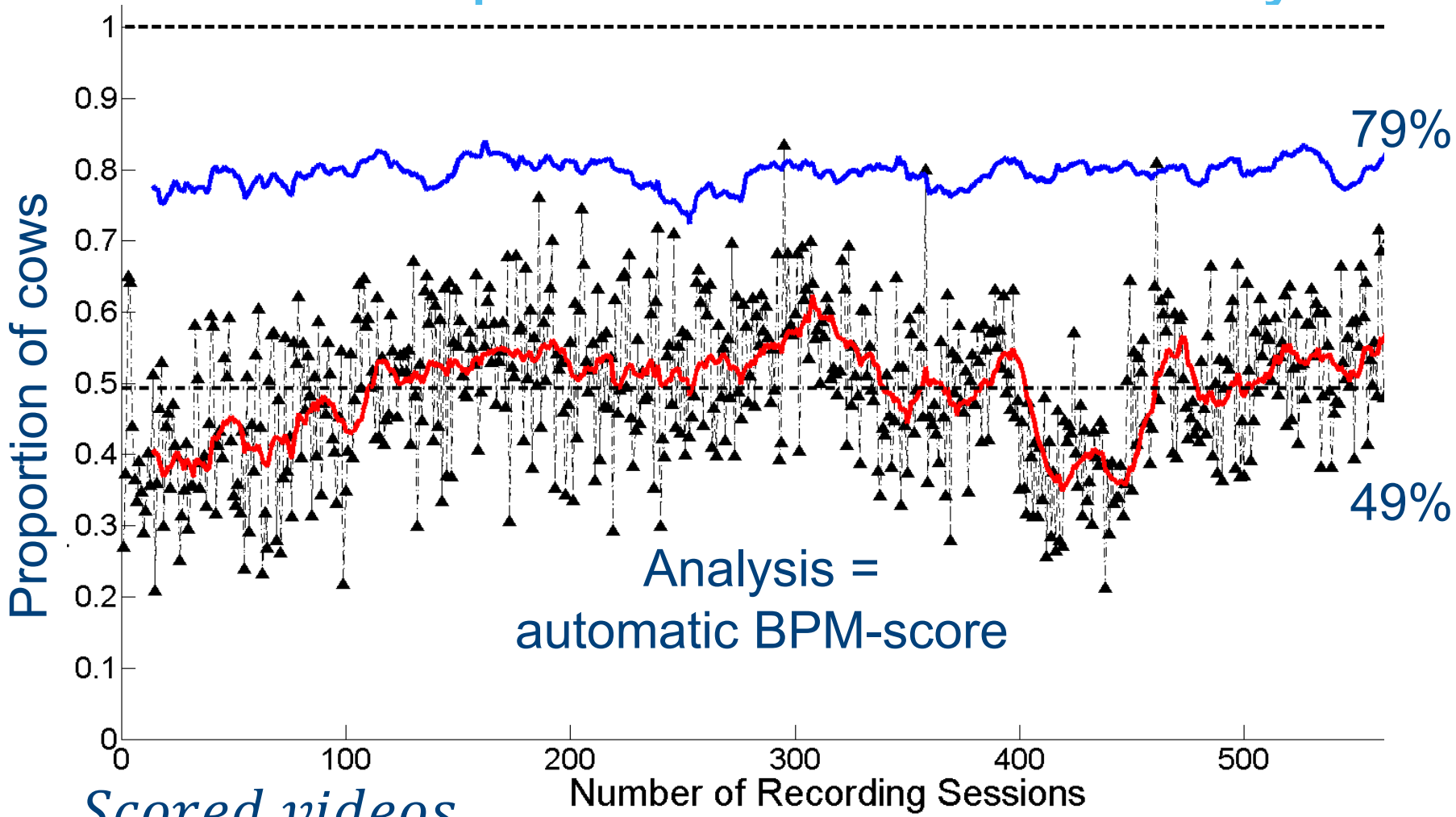
Treatment

Performance per session

- 20/09/2013 – 15/07/2014
- 566 recording sessions

Step in Process	Absolute number	Relative Number [%]
Number of cows milked	226 ± 9	100
Number of cows RFID	224 ± 10	99,1 ± 1,3
Number of recorded videos	197 ± 16	87,2 ± 6,2
Number of video-cowID links	178 ± 14	78,8 ± 5,7
Number of analysed videos	110 ± 24	48,7 ± 11,0

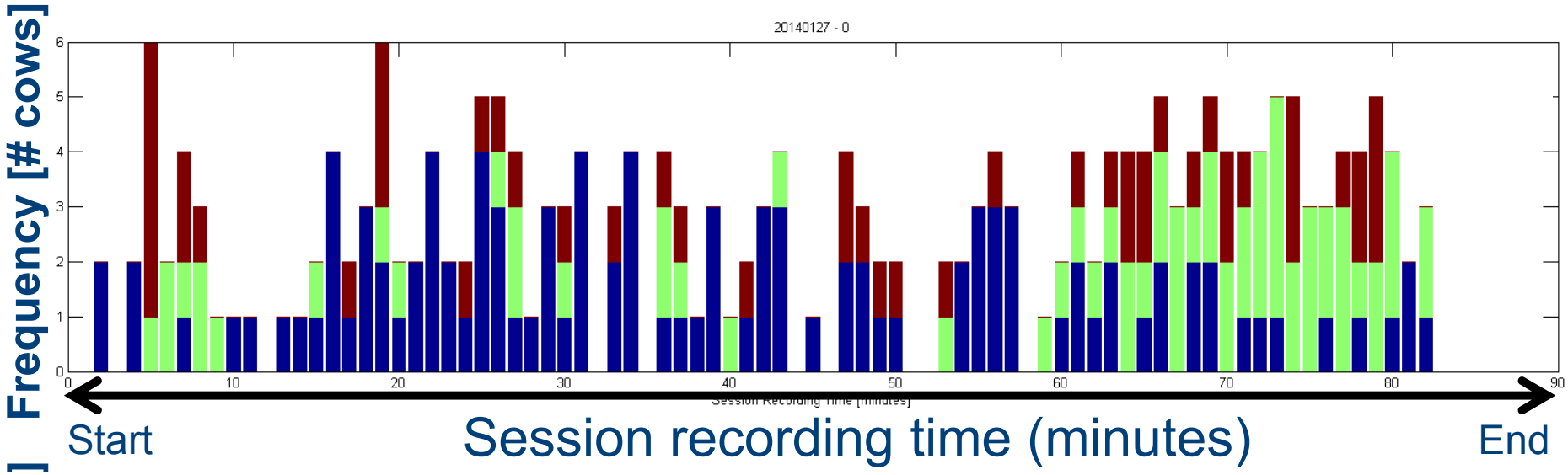
Performance per session: video analysis



$$\frac{Scored\ videos}{cowID\ linked\ videos} = 62\%$$

KU LEUVEN

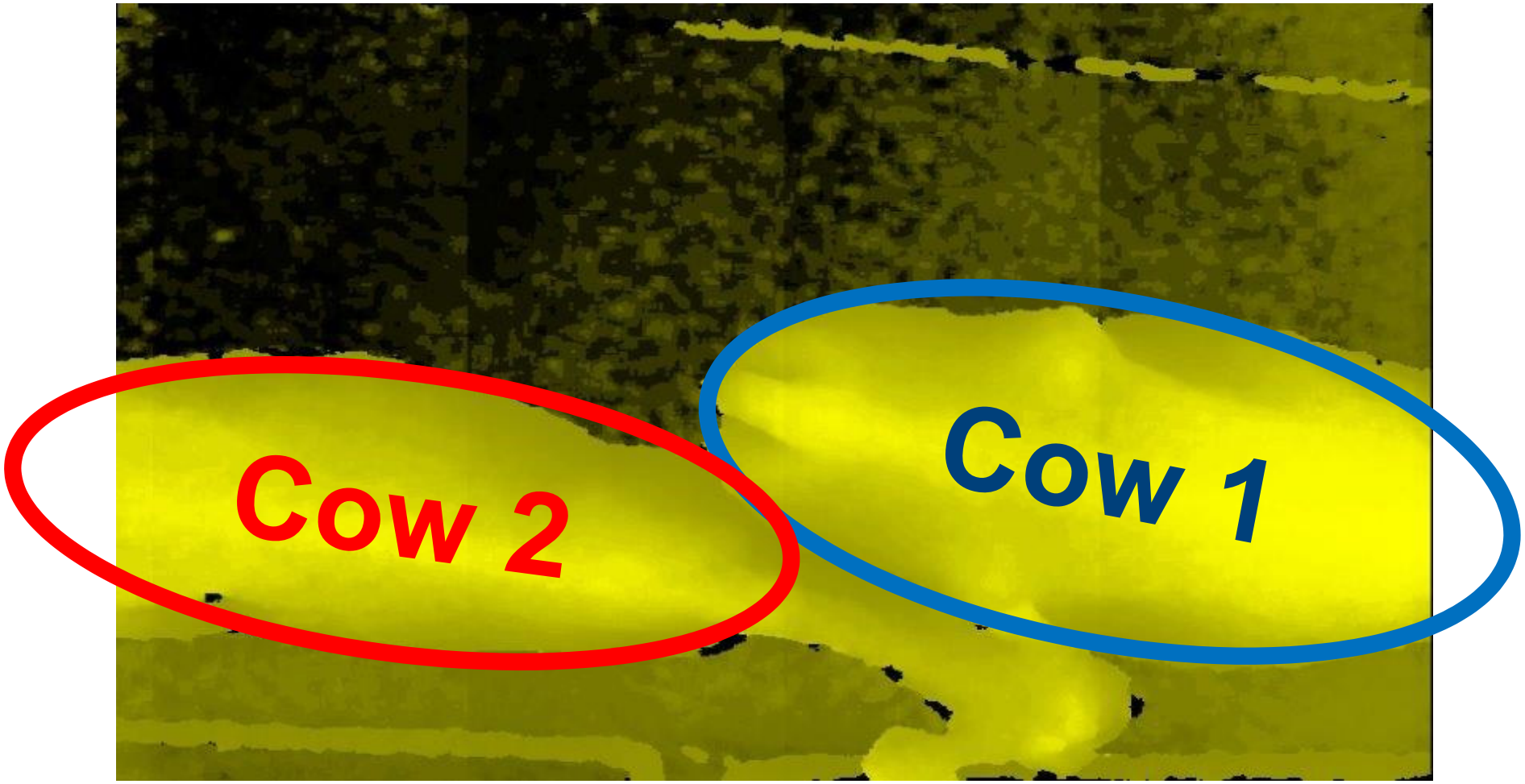
Performance during session



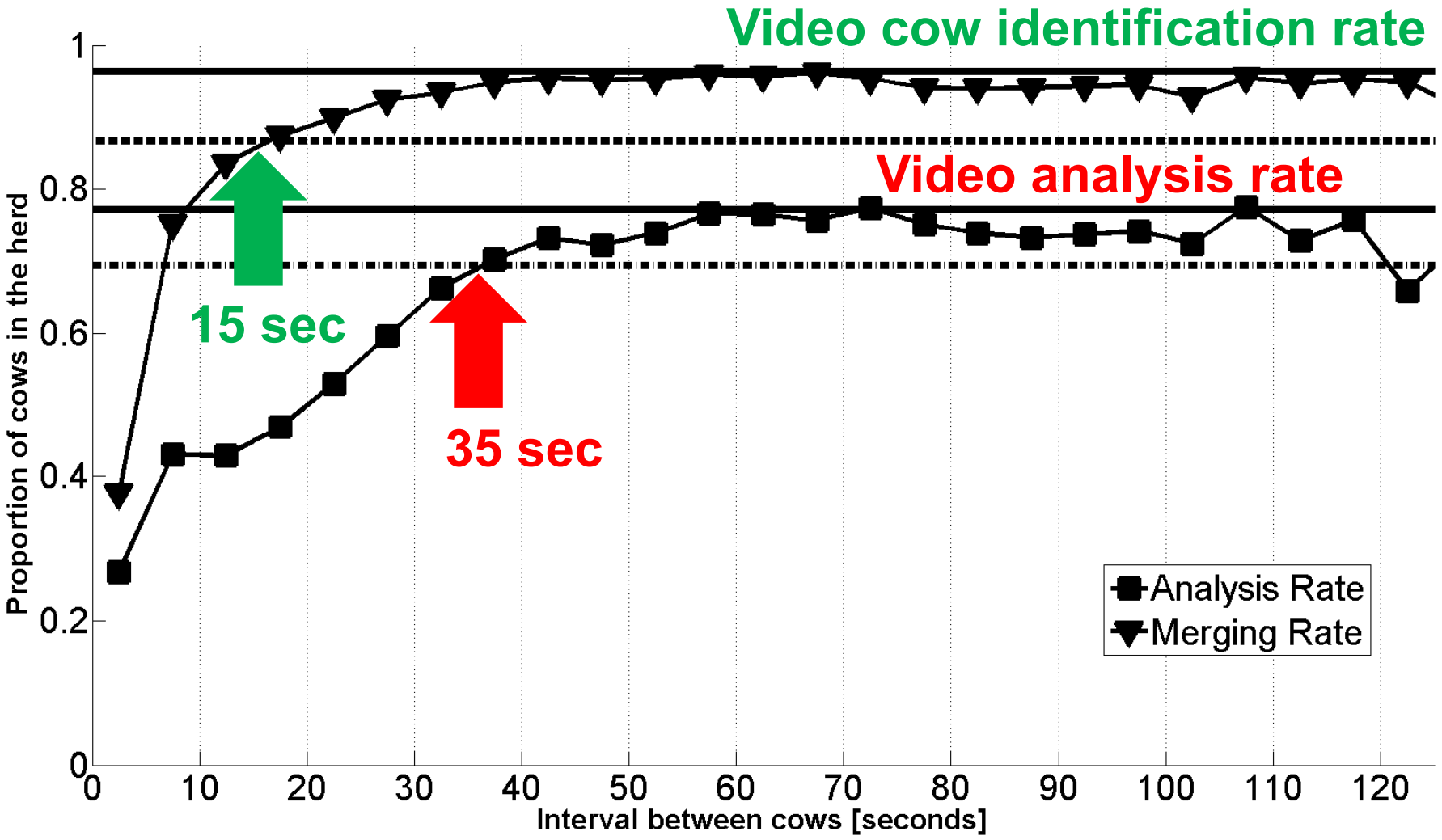
Video ID = 77,7%
BPM-score = 48,2%

MISSED
IDENTIFIED
SCORED

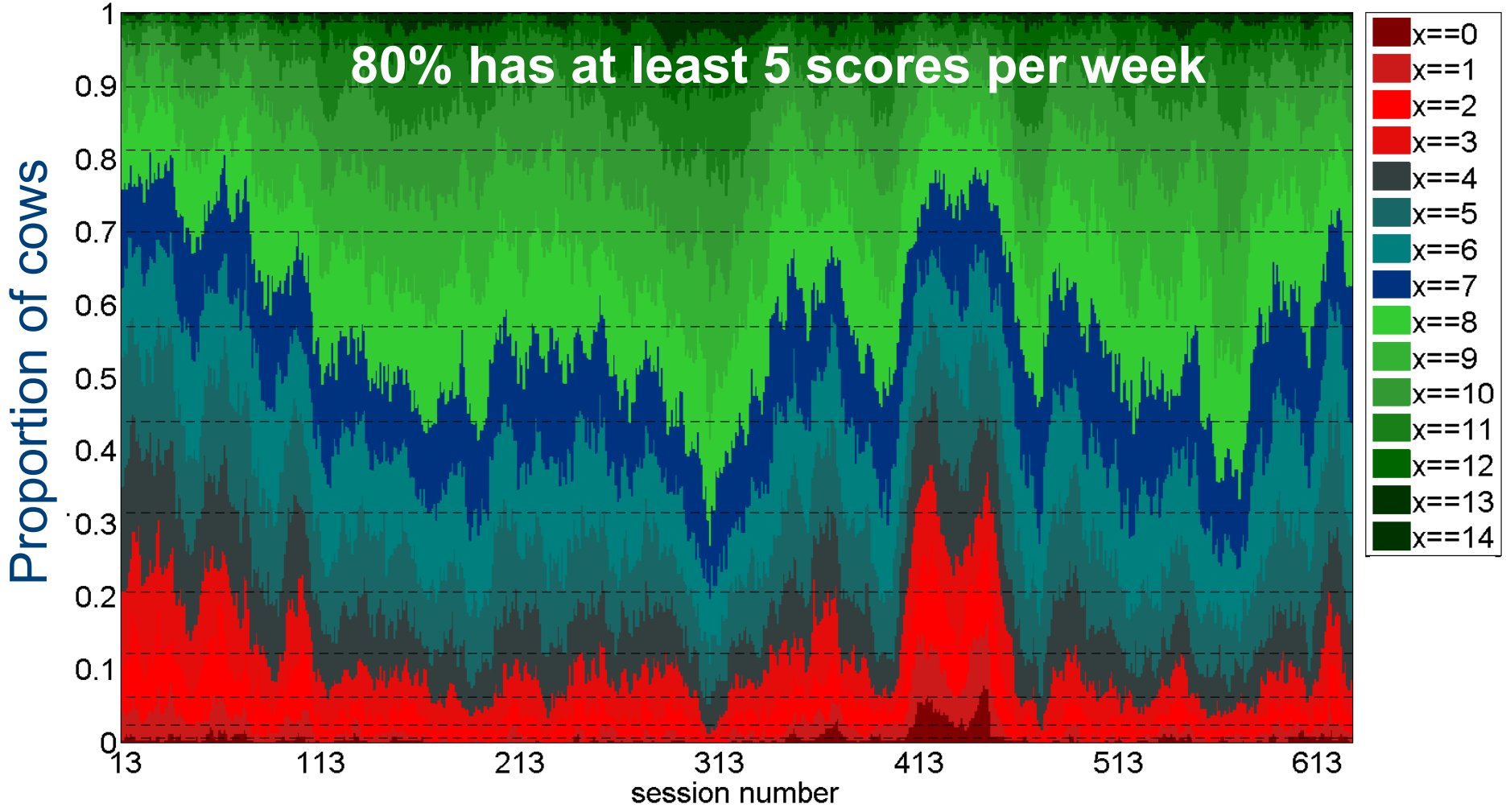
Cow traffic: crowding in alley



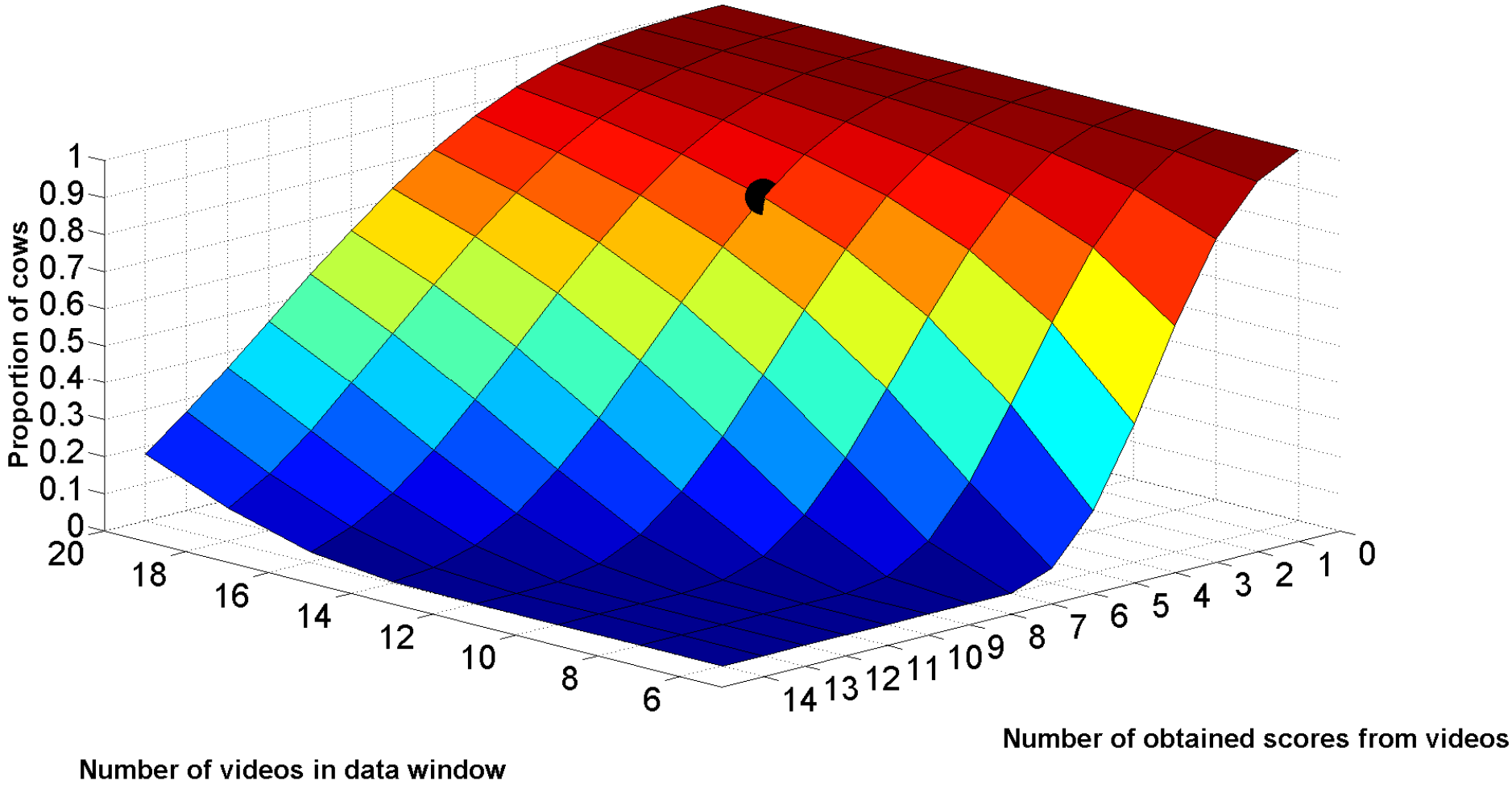
Optimal traffic intervals



Performance on cow-level (1 week)



Trade-off for selected window size

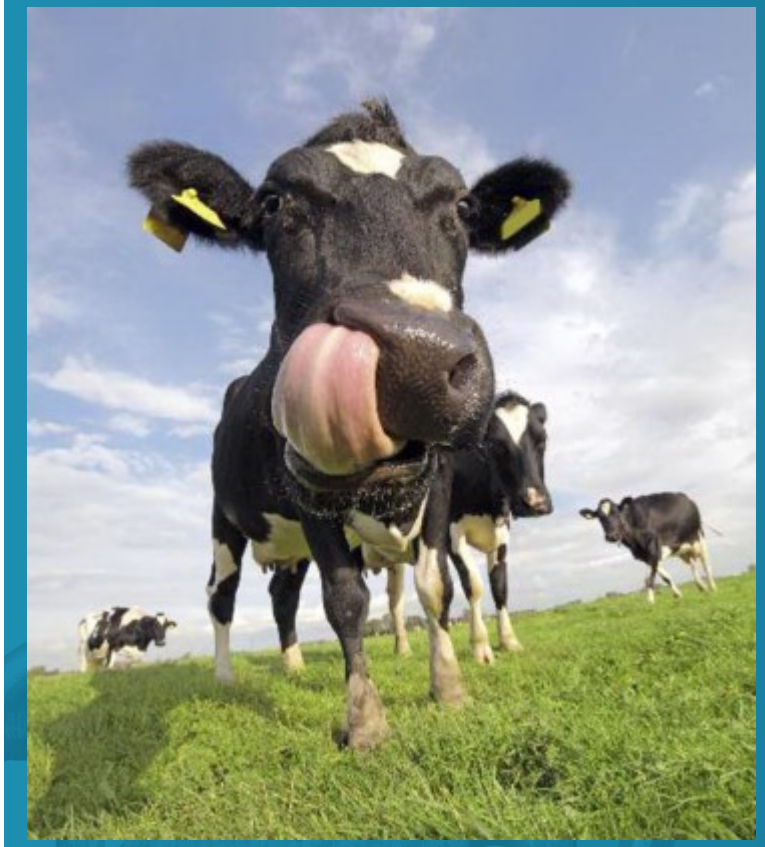


Risk factors for system performance

	Factor	Correlation coefficient
Positive correlation	Recording session duration	0,43
	Lactation stage DIM 151 -180	0,28
	Lactation stage DIM 0 -30	0,25
	Lactation stage DIM 91 – 120	0,23
	Proportion of 3rd parity	0,18
	Proportion of 4th parity	0,16
Negative correlation	Proportion of 1st parity	- 0,50
	Lactation stage DIM 241 - 270	- 0,44
	Lactation stage DIM 271 – 305	- 0,43
	Herd size	- 0,31
	Proportion of 2nd parity	- 0,16

Discussion

- Seasonal effect
  - ~ system?
  - ~ time of farmer?
- Optimal traffic intervals for free cow traffic
- How many scores do we need for lameness detection?
- Type of milking parlour ~ location of recording system



Credit to www.sheptonmalletjournal.co.uk

Conclusions

- The system scored 48,7% of the cows in herd per session
- System performance better for old cows in early lactation than young cows in late lactation
- Optimal cow traffic interval = 35 sec.

Thank you!

Corresponding author:
tom.vanhertem@biw.kuleuven.be

KU LEUVEN

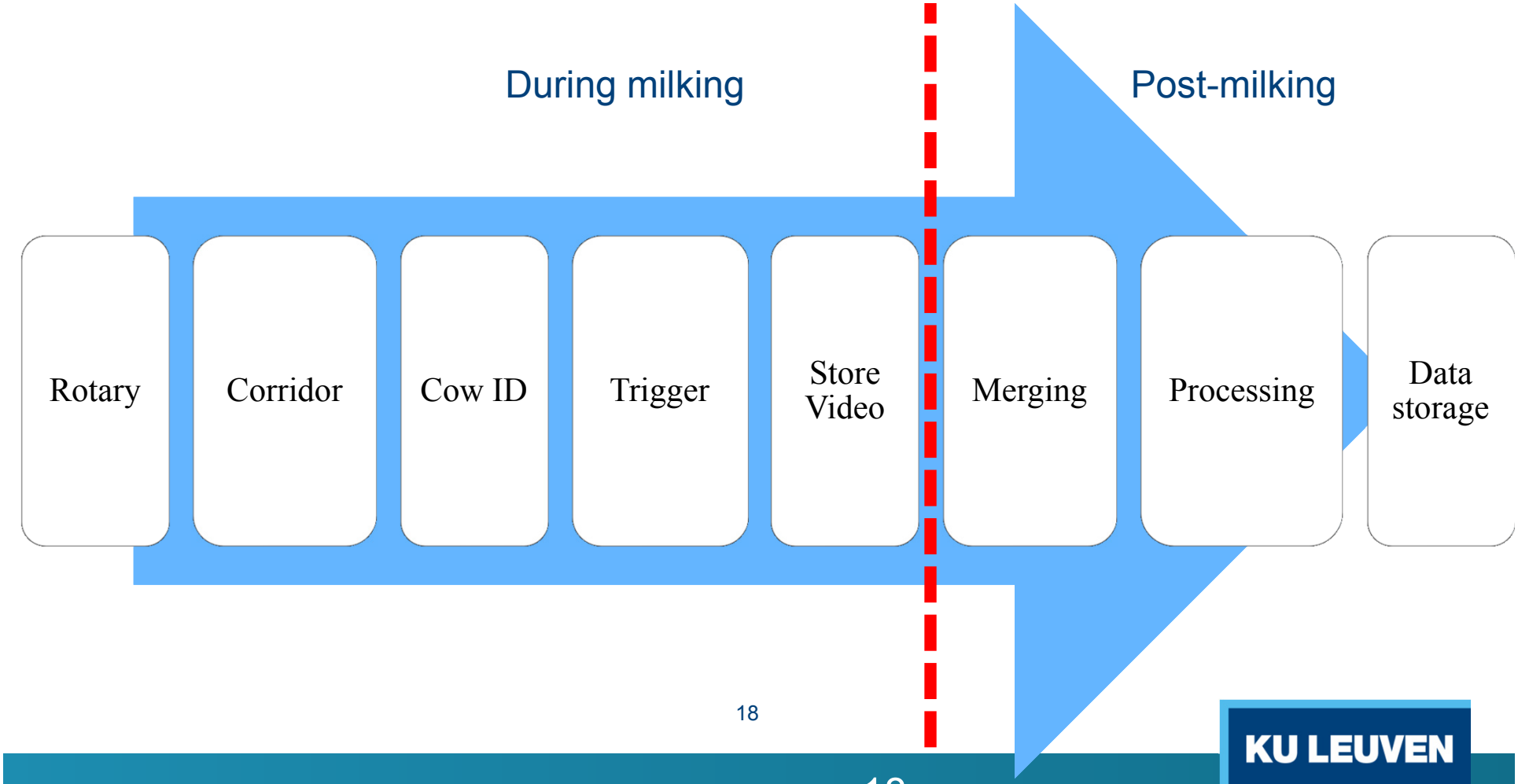
Funding: Industrial Research Fund (IOFHB/13/0136) of the Flemish Government, Israeli Agricultural Ministry Chief Scientist Fund 459-4426-10 and 459-4369-10

Commercial farm layout

- Commercial Belgian dairy farm
- 40-stand rotary milking parlor
- 210 - 240 cows
- 2 production groups [high - low]

Process flowchart

- Fully automatic video recording & processing

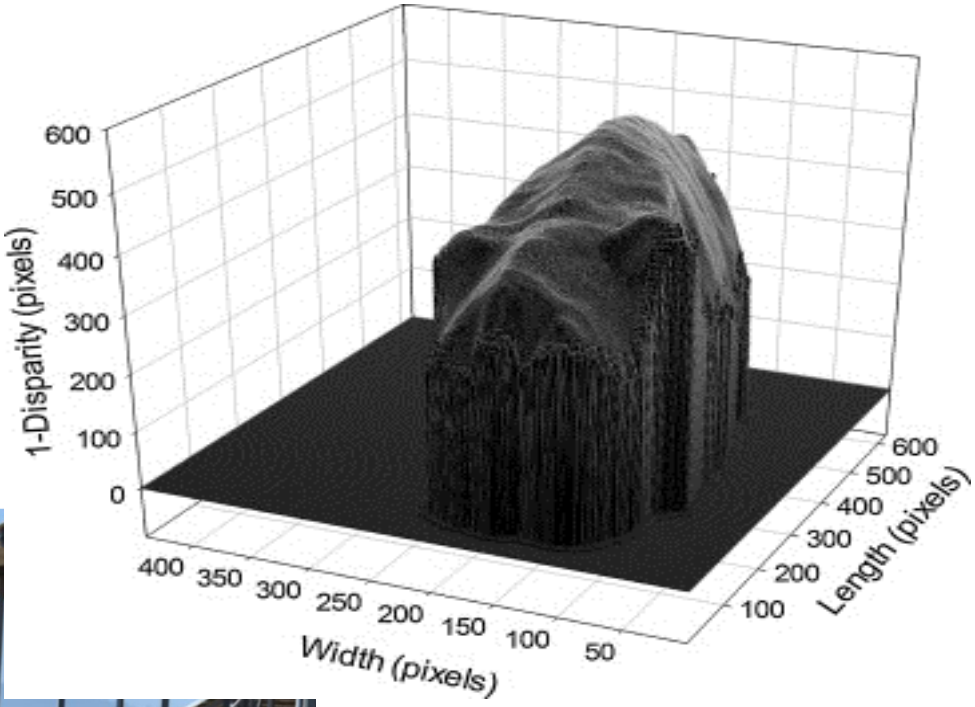


Process automation

- Fully automatic video recording & processing
  - Automatic trigger → photocell
  - Automatic identification
    - RFID-antenna
    - Timestamp correlation
      - Recording time stamp
      - RFID time stamp
      - Time delay (every session re-estimated!)
  - Automatic analysis (**BPM**-measurement)
    - Offline
    - After the milking + recording session
    - Filter to select good videos

ALD0-setup

- Back Posture Measurement **BPM**



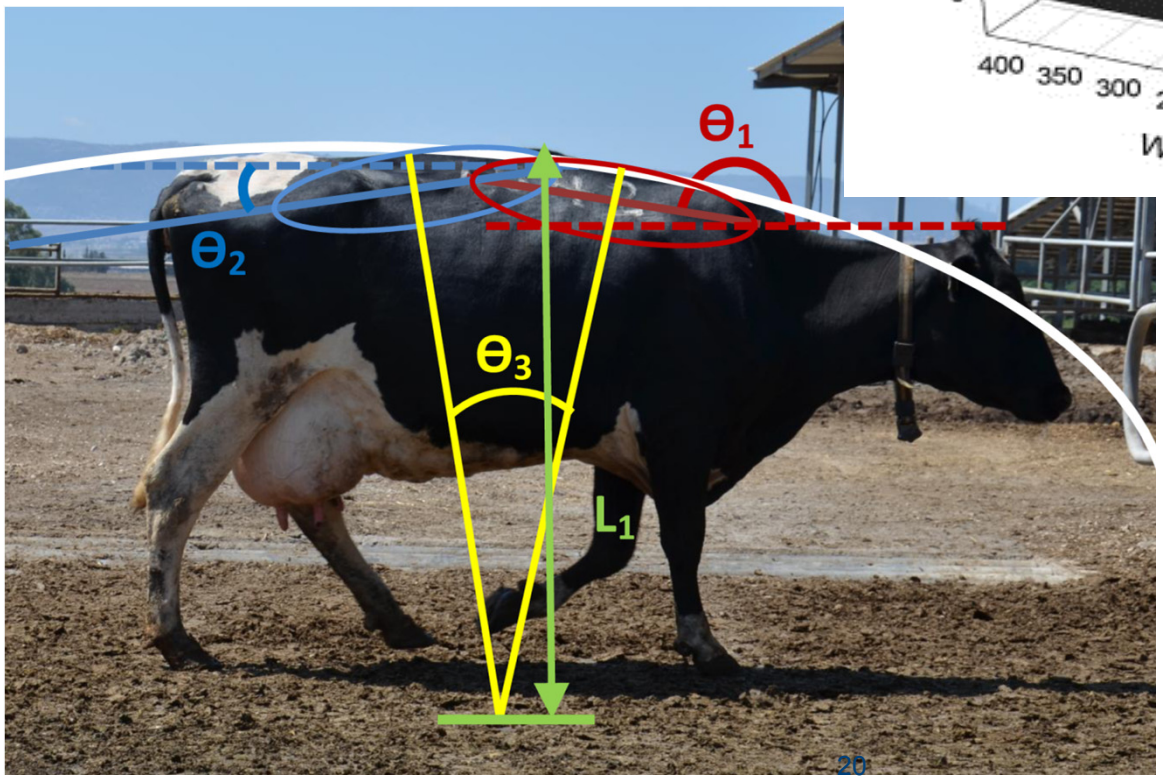


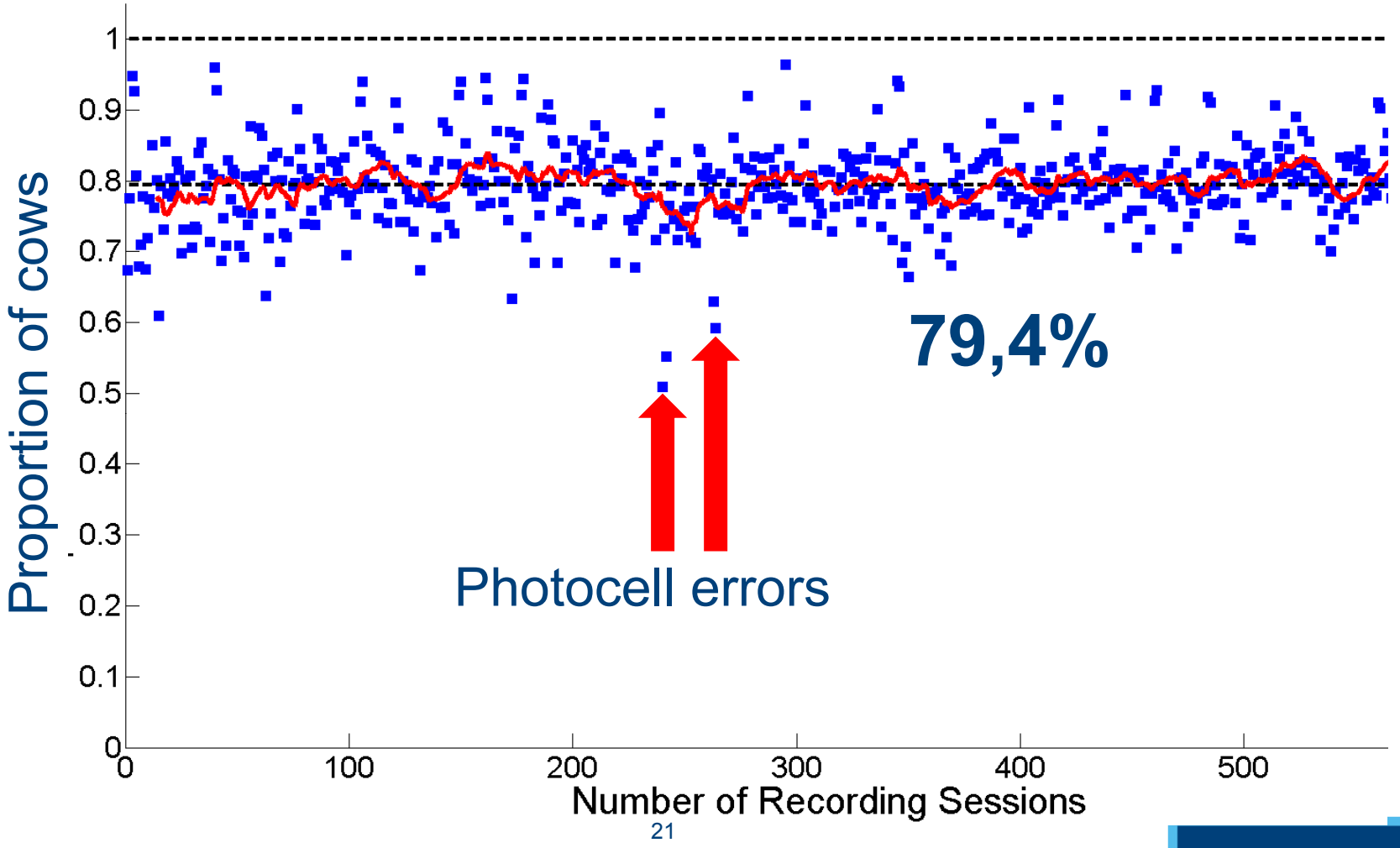
Fig. 7 Parameters θ1 , θ2 , θ3 and L1 extracted from the reconstructed back curvature of the cow.

Comparison of a three-dimensional and two-dimensional camera system for automated measurement of back posture in dairy cows

Computers and Electronics in Agriculture Volume 100 2014 139 - 147

KU LEUVEN

Performance per session: link video-cowID



KU LEUVEN

Seasonal effect on analysis rate